Promoting Academic Excellence Amongst The Engineering Students

Hanim Salleh, Mohd Azree Idris, Abdul Talip Zulkarnain
Halimatun Hashim, Zaimah Hasan and Izham Zainal Abidin
Kolej Kejuruteraan, Universiti Tenaga Nasional
Jalan Kajang-Puchong,
43009 Kajang, Selangor
hanim@uniten.edu.my

Abstract: This paper describes activities carried out by the College of Engineering at Universiti Tenaga Nasional (UNITEN) in order to promote academic excellence amongst the engineering students and to enhance their academic standings. The issues affecting the academic performance are briefly discussed. The activities involve all students majoring in Electrical, Mechanical and Civil Engineering at UNITEN. The discussions highlight some examples of the orientation and motivation programs, student support system, engineering related enrichment activities and outcome-based education. The objective of this paper is to share the experiences gained when conducting these activities and how they benefit the students.
Keywords: Academic excellence, engineering education, student performance, student support, CGPA.

1. Introduction

Promoting academic excellence amongst engineering students has been the corner stone for every academic institution all over the world. In order for students to be academically excellent, they would require a sound character and well being. For the academically strong students, the programmes presented in this paper would help to enhance further both their academic performance and their character as future engineers. On the other hand, for the academically weak students, these programmes would help to improve their academic standing. UNITEN academic regulations specify that if a student carries a cumulative grade point average (CGPA) below 2.0 he or she will be put under academic probation. However, if the CGPA is still below 2.0 for two consecutive semesters, the student would be dismissed from the university. The College monitors the progress of students who are under the academic probation via various student support programmes. Based upon observations made, students who follow the programs organised by the College manage to improve their academic standings. Therefore, the College has formed a committee to develop a more structured and systematic academic activities for all engineering students and design programs tailored for the weak students.

A study carried out in the United States shows that a substantial percentage of the students who leave the engineering programme before graduation would have undergone probation in their first term of tertiary education [1]. Astin and Astin [2] observed that majoring in engineering has negative effects on students' satisfaction with faculty, quality of instruction, student life, and overall college environment. Various approaches of reducing attrition are discussed by Jensen [3] and Brainard and Carlin [4]. Students' performance and retention are also related to the opinion students have of themselves in areas such as study habits and communication skills [5]. The transition from high school to college, the adjustment to college life, time and stress management are factors that affect academic performance [6,7]. Psychological variables which affect performance include feelings of alienation and loneliness [8, 9] and difficulties in emotional adjustment [10]. Apart from that, Salleh et al. [11] also discussed that academic performance can be related to the students' ability to grasp the engineering applications. Fig. 1 shows the overview of the issues that may affect the academic performance of engineering students.

This paper emphasizes on the approaches and activities carried out by the College of Engineering in UNITEN. These activities are designed with the objective to enhance students' self-empowerment and resilience in facing challenges in students' academic life hence ensuring academic excellence. The discussions in this paper are divided into four categories, which are orientation and motivation programs, student supports, engineering related enrichment activities, and outcome based education as shown in Fig. 2.

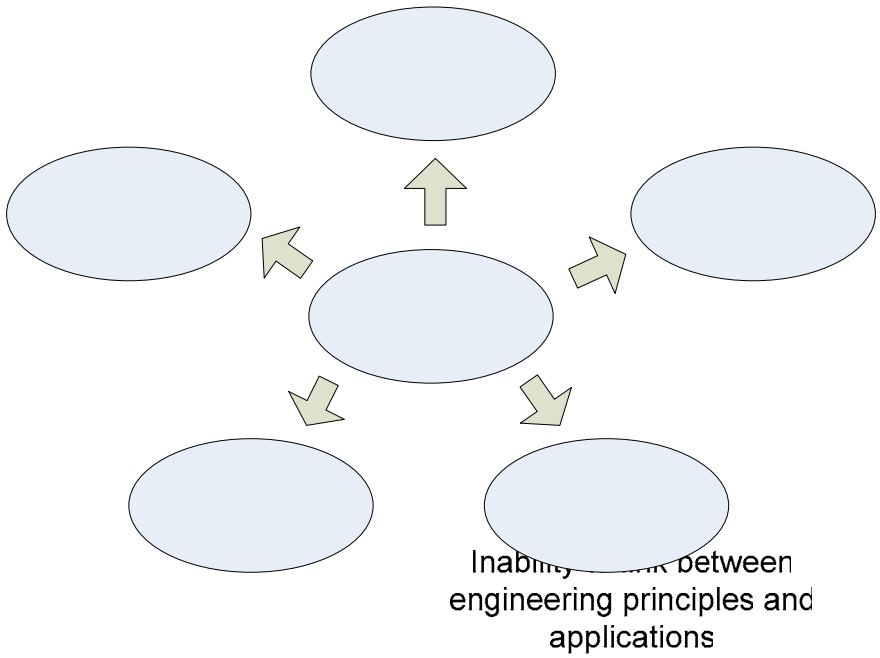

Fig 1. Some of the issues highlighted that may affect the academic excellence of engineering students in UNITEN.

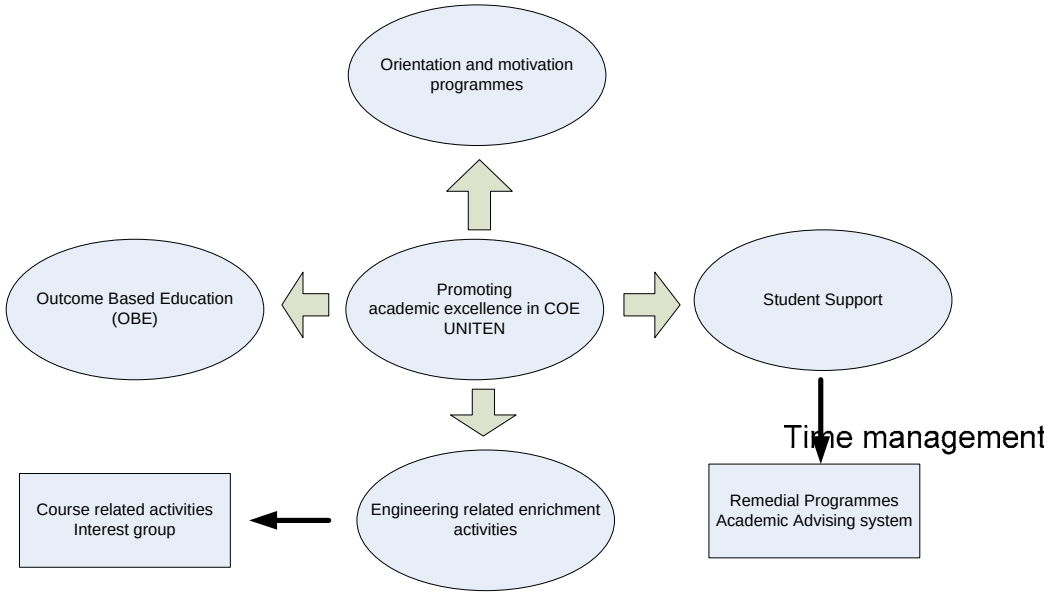

Fig 2. Activities carried out by the college of engineering in promoting academic excellence in UNITEN.

2. Orientation and Motivation Programs

Most of the students enrolled in the Foundation Program are fresh from school. Due to this, every foundation student would have to go through an orientation program. This program acts as a transition stage, helping them to adjust and expose themselves to university life. Talks and group activities facilitated by the students' representative council also known as the Majlis Perwakilan Pelajar and closely monitored by UNITEN student affairs unit are

programmed intensively to help students to build up community network among them and to test their resilience towards university life. In this program students are also guided on subjects' registration and the use of the library as a research and reference centre. The orientation programme focuses more on study skill and future career development in the engineering field. Academic staffs who are also their potential academic advisors (AAs) are introduced in this session. AAs are then given the responsibility to monitor the advisees' academic achievement since AAs have the facilities to access their advisees' academic progress and other personal details on-line. Subjects' lecturers may inform the respective AAs if students are absent from classes for more than three times or do not perform well in their course work or vice versa. At the same time the subjects' lecturer may inform the Head of Department to later communicate with the parents if students are absent from classes for more than three times.

Another program that has been planned by the student affair and the student development committee of the College of Engineering (COE SDC) as pilot program starting June 2006 is a program called 'campus survival'. The program is designed to equip each batch of new foundation students in two semesters. At the third week of the first semester, group activity on study skills is handled by the academic staffs. In the following semester, the same students will have to discuss on their achievements and ways to improve them.

As for degree students, the student development committee of the College of Engineering (COE SDC) conducts its own academic orientation program according to the department. This orientation is aimed to provide students with better perspectives of their respective majors. A sample program conducted by the Mechanical Department is shown in Table 1. Students will be introduced to the department academic staffs and their area of expertise. A motivational talk is delivered followed by a forum with the excellent students who shared some valuable experiences in managing college life and study skills. In the orientation session, an academic performance monitoring system is introduced. An award ceremony for the top students in the senior year is conducted as a motivation the new students. An engineering design competition was also conducted in the orientation program. An informal survey was distributed at the end of the session.

Table 1: Sample Orientation Program Conducted by Mechanical Engineering Department, UNITEN

	Activities
1.	Ice breaking session with the academic staff
2.	Motivational talk
3.	Forum with excellent graduated and present students
4.	Academic performance monitoring – logbook and computer advisory systems
5.	Award ceremony for top students
6.	Engineering design competition
7.	Informal survey

3. Student Support

1) Remedial program

Even though students are exposed to various academic facilities, motivational talks, and study skill during the orientation week, weak students would find it difficult to grasp most of the information. This could be due to the feeling of homesick, fatigue and other psychological variables. Hence, these students could drift into the sudden freedom in their university life. In order to avoid these problems, remedial program is introduced as a wake-up call for these students to check on how they manage their time, stress and study habits, and improve their academic achievement before it is too late. The remedial program is conducted for weak students with CGPA of less than 2.3. In a pilot project, students having less than 40 credit hours are made compulsory to attend academic consultation sessions conducted by 20 academic guiders. These academic guiders have undergone basic counselling training to ensure the correct approach is given to the students.

A seminar entitled 'Beyond UNITEN' was conducted for students having CGPA of 2.00 to 2.30, with an objective to provide motivation and sense of awareness on the importance of achieving a good CGPA. The number of students who participated in the remedial program was 141. Questionnaires were given out during the program in order to assess the level of adaptation of the students at the university level and their study habits and inclination. The weak students were asked whether they experienced overwhelming pressure at any point during their academic life in the

university. 62% of the students agreed that the pressure was overwhelming. In terms of interaction with the lecturers, 54% of the students said they did not have any lecturers that they felt comfortable to discuss matters related to their studies. Interestingly, 65% of them felt that if they didn't like a particular lecturer, this would affect their grade in the class that the lecturer taught. On the question whether they have found a study technique in which they were comfortable with at the university level, 52% of them said no.

A motivational talk and forum was organized for other group of 67 engineering students having less than 40 credit hours with CGPA lower then 2.00. As part of the programme, a case study session was carried out. It was aimed to encourage the students to diagnose possible problems that could affect their studies. Participants indicated their ability to suggest some solution to the problems. They also realised that they could apply the same approach discussed during the session in order to tackle their own problems.

Generally, from the questionnaire distributed during the programme, it was noted that the participants were not satisfied with their study habits. 41% were not even sure of their study habits. Poor time management was found to be one of the problems faced by the participants. The effect of surrounding environment and the distraction related to it were factors that discouraged the participants in doing revisions and self study. Apart from that, typically, a lecturer would give clues for each chapter of the textbook. These clues would be useful for the student in studying and assignments. However, a majority of 59% of participants failed to go through the whole text before attempting the subchapters in the textbook. In terms of reading skills, their level of reading skill was moderate as 65% stated that they seldom practice taking notes while reading the text or questioning themselves on what they had just read. The participants also did not demonstrate a regular study pattern. Nevertheless, they usually organized the materials for the ease of memorizing. In terms of listening skill during lectures, it was noted that the participants frequently did take notes, refined and revised the notes immediately after lectures. Involvement in lectures and attendance were found to be of similar pattern where participants indicated only a slight interest and concern for its importance. The participants handled tests and quizzes with no pressure and showed lack of strategy in attempting the quizzes or tests.

In general, this program was rated to be very affective by the participants. They gave the highest credit to the motivational talk delivered by the invited speaker. 38% of the participants rate the activities during workshop to be excellent. They described the program as useful and beneficial.

2) Academic Advising system

The computer advisory system at Uniten provides various features for academic advisors to keep track the academic performance of their advisees. The Student Information page allows the academic advisors to view the records of their advisees. Important information such as the contact numbers, addresses, next of kin and email address can be obtained on the page. The classes taken by the advisees during the present semester can be viewed online, Fig. 3. An academic advisor can also view the present academic standing of their advisees. For example, they can sort their advisees based on the CGPA, and from there they can easily identify advisees that are weak and need attention, Figs. 4 and 5.

Day	800	900	1000	1100	1200	1300	1400	1500	1600
Monday				MATB143				MATB253	MEMB123
Tuesday	MEMB123	MATB143		MATB253					MEMB123
Wednesday		MATB143		MATB253					MEMB123
Thursday		MATB143		MATB253			MORB113		
Friday	MEFB121	MEFB121	MEFB121	MEFB121	MEFB121				
Saturday									

Fig 3. An advisee's timetable can be viewed online by the academic advisors.

No.	Student ID	Name	Status	CGPA	GPA	Total Credits
25.	AM1	Ras	Active	1.91	0.80	34
26.	AM2	Rid	Active	2.13	1.20	33
27.	AM1	Rya	Active	2.19	1.71	38
28.	AM2	Nur	Active	2.28	1.43	28
29.	AM2	Akm	Active	2.29	1.76	38
30.	ME07	Aiz	Active	2.29	2.75	29
31.	AM1	Azr	Active	2.36	3.33	36
32.	AM2	Azl	Active	2.40	4.00	28
33.	ME07	Mohd	Active	3.00	3.00	15
34.	ME07	Kam	Active	3.24	3.50	100

Fig 4. The CGPA is sorted in an ascending order. (Note: The student IDs and names are truncated for confidentiality).

No.	Subject Code	Description	Credits	Semester	Status	Grade
1.	ISLB123	Islamic Studies 11	3	2003/4S1	Pass	B
2.	MATB314	Linear Algebra	4	2003/4S1	Pass	A
3.	MEMB214	Mechanics I - Statics	4	2003/4S1	Pass	B
4.	MESB203	Engineering Measurements & Lab	3	2003/4S1	Pass	C
5.	MALB113	Malay Language	3	2003/4S2	Pass	B
6.	MATB214	Calculus & Geometric Analysis III	4	2003/4S2	Pass	B-
7.	MEFB211	Manufacturing Processes Lab	1	2003/4S2	Pass	A-
8.	MEFB213	Manufacturing Processes	3	2003/4S2	Pass	A
9.	MEMB224	Mechanics II : Dynamics	4	2003/4S2	Pass	A
10.	MEHB244	Thermodynamics	4	2003/4S3	Pass	B
11.	CMPB164	Principles of C Programming	4	2004/5S1	Pass	A
12.	ENGB123	English Language II	3	2004/5S1	Pass	B
13.	MATB224	Differential Equations	4	2004/5S1	Pass	C+

Fig 5. The advisor can view the grades obtained for the subjects taken by an advisee.

Two methods have been introduced to monitor the students' academic progress throughout the semester: log-book and computerized online monitoring.

The objective of the log-book is for students to discuss their progress with their respective academic advisors. They need to meet their academic advisors once every two weeks to report their progress. The progress involves the marks they obtained in assignments, quizzes and tests. From this meeting the academic advisors can make an early detection the areas where the students need helps, and subsequent arrangements can be made. Other issues which related to the students' academic performance will also be discussed during this meeting.

The purpose of the online monitoring is to ensure that the students are keeping pace with their classes. The online monitoring system allows the students to key in the scores that they obtained in assignments, quizzes, and tests on the website, and put comments for each of the scores, Figs. 6, 7, 8. Points will be awarded by the advisors for the entries made by the students. For example, 2 points are given if a student put the score he or she earned in a quiz. The online monitoring system gives an avenue for the academic advisors to monitor the advisees' performance throughout the semester.

No.	Date	Description	Status	Points	Approve?
1.	25/07/2005	Quiz	Verified on 03/08/2005	2.00	
2.	28/07/2005	Quiz	Verified on 03/08/2005	2.00	
3.	02/08/2005	Quiz	Verified on 03/08/2005	2.00	
4.	11/08/2005	Test	Verified on 12/08/2005	5.00	
5.	16/08/2005	Quiz	Verified on 16/08/2005	2.00	
6.	05/09/2005	Test	Verified on 06/09/2005	5.00	
7.	05/09/2005	Quiz	Verified on 06/09/2005	2.00	
8.	21/09/2005	Test	Verified on 26/09/2005	5.00	
9.	27/09/2005	Quiz	Pending Verification	N/A	Yes
10.	28/09/2005	Quiz	Pending Verification	N/A	Yes
				25.00	

Fig 6. A sample of the verification made on the marks entered by the student.

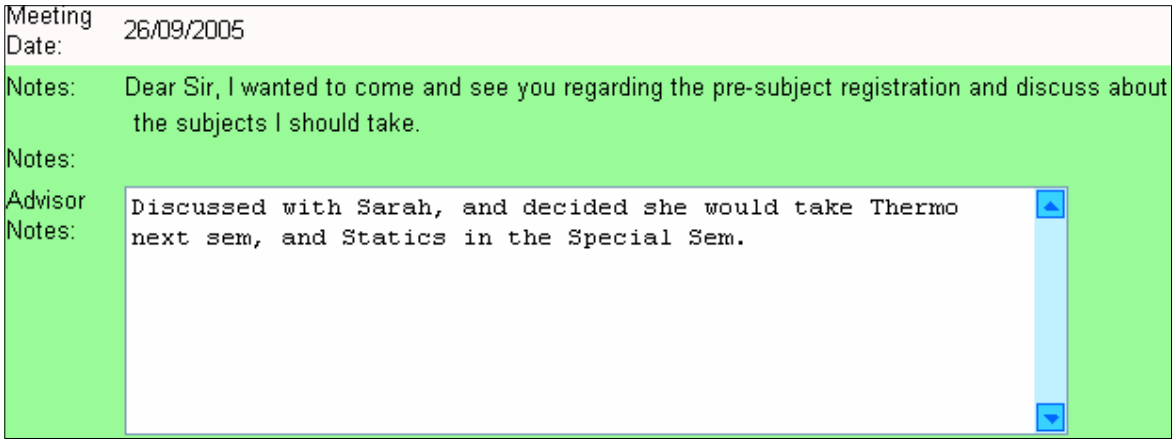

Fig 7. A sample of the online note sent by an advisee and the remarks made by the advisor after meeting with the student.

Student ID:	ME076
Name:	
IC No.:	86063_
Class:	METB113 Section 03
Subject:	Engineering Materials
Type:	Quiz
Quiz Date:	25/07/2005
Score:	2/10
Notes:	Sir can i meet you some time this week?
Status:	Verified by DR. MOHD AZREE BIN IDRIS at 03/08/2005 19:26:21

Fig 8. A sample of the quiz score (2/10) entered by the advisee and the notes left by him to the advisor.

4. Engineering related enrichment activities

In promoting academic excellence, students should be able to grasp the underlying concept of the course content. Traditional lecturing and tutorials should be blend with other course enrichment activities such as projects, 'board quizzes', computerized homework, bonus competitions and even extra curriculum interest group. Some of the courses are Numerical Methods for Engineers, Computational Fluid Dynamics (CFD), Finite Element, Circuit Analysis simulation exercises using PSpice, Power System Protection (relays maintenance and commissioning tests) and Power Electronics simulation exercises studies using MatLab. The following are the brief discussions of the engineering related enrichment activities on the software used to enhance learning of numerical methods, Power Electronics simulation exercise using MatLab, Power System Protection course and Mobile Robotic Group.

1) Software to Enhance the Learning of Numerical Methods

Numerical Methods is a subject taken by the third year engineering students. In the course, mathematical problems are formulated so that they can be solved with arithmetic operations (computers). The challenges faced by the students are to adapt to the transition from mathematical approaches to numerical methods using computers and to be able to understand and know the various methods covered in the course. A software has been developed for the course to enhance students' understanding. The software acts as a personal tutor that guides the students in working on the numerical problems. A student will work through the set of questions in the software, and once all the questions have been answered by the student, the software will generate a unique code in which the student needs to submit on the class website, Fig. 9.

Posted on: August 25th, 2005, 5:59am

Dateline: 29-August-2005 12:00:00
Homework 4
25-Aug-2005 05:52:31
This homework is performed by Mohd Akmal Aniq Bin Ab Kadir (EP072242 - 3A)
Total time taken is 482.59 minutes
Code: 15503.462198

Fig 9. Generated code posted by the student on the website

The software enables to the students to meet the standard guideline at the university level which states that for every one hour spent in a classroom students should spend 2 hours outside of the classroom. The software allows the students to master the fundamentals covered in the course, and it reduces the performance gap between weak and good students.

2) Power Electronics simulation exercise using MatLab.

Power Electronics are seen to be a difficult subject since it involves heavily on a thorough understanding in mathematics and electronics. Due to this, in order to improve the students' understanding in this area, power electronics laboratory exercises and computer based simulations were introduced. The objective of the power electronics laboratory would be to give an introductory hands-on skill in building and analyzing power electronic circuits. The types of laboratory work introduced would range from exercises that require the student to study the basic principle of power electronic devices up until an application example of a power electronics circuit. Based upon feedbacks obtained from students, the lab exercise does help to give further understanding on the subject apart from what was learnt in the classroom. However, using laboratory exercises is not enough to cover all aspects of the subjects due to lack of time and facilities. Due to this, computer simulations were introduced. These computer simulations would require the student to design a power electronic circuit and obtain the necessary simulated waveforms. This approach would further improve the student's understanding on the basic equation and the necessary formulation in designing an effective power electronics circuit.

3) Power System Protection

Besides learning the principles of operation of various types of protection relays and their applications in power system, students are introduced to different types of regular maintenance tests and commissioning tests carried out by the utility and industries according to the specified standard. This is an elective subject and opted by the students during their final year; hence, it is a good transition for the students to have some exposure on the real types of testing on site. Good comments are given by former UNITEN students who are now working with various companies on the relevancy of the relay testing to their work and their early exposure.

4) Mobile Robotics Group

The mobile robotics group was first started by a group robotics enthusiast consisting students and lecturers. The initial idea of the group was to create a platform where both students and lecturers can practice any academic theories into practical application. Currently, the mobile robotics group has been able to attract students and lecturers to join their activities e.g. Educational Talks in Secondary Schools, SEED by Shlumberger, Robotics related competitions, e.g. UNITEN internal competitions, ROBOFEST and ROBOCON organized by SIRIM and the ASIAN Broadcasting Union (ABU). The advantage of this group is that students were given the opportunity to design and build robotic systems depending upon prerequisites given to them. Hence the students were given the opportunity to practice what they have learnt in class.

It can be seen for example with the existence of the mobile robotics group, there are an increasing number of students who are interested in these areas which has indirectly prompted them to do robotic related final year projects. With the availability of student based activities mentioned earlier, students portray a positive attitude towards engineering. The students are more confident in designing systems and it gives them the ability to work in groups.

5. Outcome Based Education (OBE)

There has been an increase awareness of the importance of OBE in tertiary education sectors. Following the fact that Malaysia is a provisionary signatory member of the Washington Accord, the Engineering Accreditation Council has been seriously implementing OBE in the engineering related programs. Therefore, this has also prompted the College of Engineering (COE) to attune its teaching and learning process towards OBE. The current status of OBE implementation in COE has reached to its pilot implementation of OBE in the first year engineering subjects (Course). The Course Outcomes (CO) for every subject would be linked to the engineering degree program outcome (PO) and ultimately linked back to the engineering program education objectives (PEO). This is illustrated in fig. 10.

The implementation of OBE into the engineering subjects would give an opportunity for COE to continuously improve its teaching and leaning process. These outcomes would then be compared with the ideal outcomes initiated by UNITEN stakeholders consisting of TNB and Industrial Panels. Based upon these comparisons, the teaching and learning process may be improved further. In short, OBE implementation is expected to increase the students understanding and their ability to grasp engineering knowledge which would lead to academic excellence.

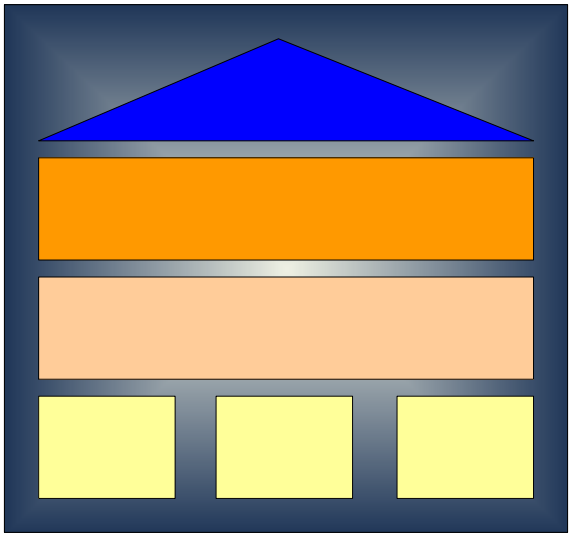

Fig 10. General building block of OBE implementation in UNITEN

6. Conclusion

The activities to promote academic excellence carried out by the college of engineering, UNITEN have been discussed. The activities discussed include orientation and motivation program, the engineering related enrichment activities and student support. However, more efforts must be given to increase the students' appreciation towards these activities. Most of these students would only realize that these activities would be beneficial to them only after going through it. The students have the impression that these activities would be burden to them rather then aiding them to achieve academic excellence. It is also hoped that the activites together with the implementation of OBE into the engineering program in UNITEN continuous improvement process is established. Hence, academic excellence is expected to improve in the near future.

PROGRAMM
(P

COURSE
OUTCOMES 1

COU
OUTCO

References

[1] Budny, D., LeBold, W. 1998. "Assessment of the Impact of Freshman Engineering Courses," *Journal of Engineering Education*, Vol. 87 No. 4, October, pp. 405-411.

[2] Astin, AW and Astin, HS .1992. Final Report: Undergraduate Science Education: The Impact of Different College Environments on the Educational Pipeline in the Sciences, Higher Education Research Institute, Graduate School of Education, UCLA.

[3] Jensen, E.1981. "Student Financial Aid and Persistence in College," *The Journal of Higher Education*, Vol. 52 No. 3, May-June, pp. 280-294.

[4] Brainard, S., Carlin, L., 1998. "A Six Year Longitudinal Study of Undergraduate Women In Engineering and Science," Journal of Engineering Education, Vol. 87 No. 4, October , pp. 369-375.

[5] Besterfield-Sacre, M., Atman, CJ, and Shumann, LJ., 1997. "Characteristics of Freshman Engineering Students: Models for Determining Student Attrition and Success in Engineering," Journal of Engineering Education, Vol. 86 No. 2, April, pp. 139-149.

[6] Johnson, CA. and Orr, CL. 1996. "The Professional Development Course as a Natural Extension of the Postsecondary Freshman Seminar," *Journal of Education for Business*, vol. 72, no. 2, pp. 120-124.

[7] Bishop, SL and Besterfield-Sacre, M. 1996. “Freshman Engineering Leadership Team: Student Mentors for Recruitment and Retention,” *ASEE Annual Conference Proceedings*, Washington, D.C.

[8] Bennett, C., & Okinaka, A. M. 1990. Factors related to persistence among Asian, Black, Hispanic, and White undergraduates at a predominantly White university: Comparison between first- and fourth-year cohorts. Urban Review, 22(1), 33-60.

[9] Gerdes Rotenberg, K. J., & Morrison, J. 1993. Loneliness and college achievement: Do Loneliness Scale scores predict college drop-out? Psychological Reports, 73, 1283-1288.

[10] Gerdes, H., & Mallinckrodt, B. 1994. Emotional, social, and academic adjustment of college students: A longitudinal study of retention. Journal of Counseling and Development, 72, 281-288.

[11] Salleh, H., Hussein, I., Yusoff, M.Z. and Idris, A. 1999. “Challenges in Improving Engineering Education: UNITEN Mechanical Engineering Department’s Experiences”, Proceedings of the International Conference of Teaching and Learning, 24th-25th November, Putrajaya, Malaysia.

[12] Engineering Accreditation Commission; “Criteria for Accreditating Engineering Programs - Effective for Evaluations During the 2006-2007 Accreditation Cycle”, *ABET Inc*. http://www.abet.org